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Bang for Your Buck: Pregnancy Risk as the Source of the Price Premium for Unprotected Sex

Constantine Manda *

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Abstract

Sex workers receive a price premium for unprotected sex. Research has inferred that the source of this premium is a compensating differential for STI risk. I introduce a compensating differential for pregnancy risk as a novel source through a simple model that predicts the price for unprotected sex increasing with the probability of pregnancy through decreased unprotected sex. I empirically test this using a rich panel dataset of 19,041 sexual transactions by 192 sex workers in Busia, Kenya collected during 2005 and 2006. I use the probability of pregnancy as an instrument for unprotected sex and run two-stage least-squares (2SLS) regression and find that a compensating differential for pregnancy risk is the source of the price premium for unprotected sex. The price premium for pregnancy risk is as high as USD 122 or about 16 times average price. I also test for a compensating differential for STI risk and clients' disutility for condoms, the other competing theories, and find that they are not statistically significant sources of the premium. Identifying and estimating sources of the price premium for unprotected sex will allow policymakers to implement interventions that will reduce both the supply and the demand for unprotected sex.

JEL Codes: O12, I10, J30

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1 Introduction

Sex workers receive a price premium each time they have unprotected sex. Dupas and Robinson (2012) as well as Robinson and Yeh (2011) have shown that, during health, political, or economic shocks, many women have riskier sex in order to capture income gains from this price premium for unprotected sex. This can potentially contribute to an increase in the HIV/AIDS epidemic. Identifying the source of this price premium is thus very important, particularly because sex workers have HIV prevalence rates that are higher than other groups in the population and are thus significant drivers of HIV/AIDS epidemics across many countries (UNAIDS 2010). Globally, sex workers experience higher rates of HIV infection than in most other population groups (UNAIDS 2009).[1] Identifying ways to mitigate incentives to have unprotected sex are especially important in contexts with high prevalence of HIV such as sub Saharan Africa, which has roughly five times the global average prevalence rate of HIV (UNAIDS 2012). Unprotected sex increases the STI transmission and as Oster (2005) shows, non-HIV/AIDS STI transmission can be the key factor in HIV/AIDS transmission, making STIs quite costly.

The price premium for unprotected sex is universally observed across different contexts. It has been documented in India (Rao et al. 2003), in Mexico (Gertler et al. 2005), in Kenya (Robinson and Yeh 2011), in Congo (Ntumbanzondo et al. 2006), in Chicago (Levitt and Venkatesh 2007) and, most recently, in Ecuador (Arunachalam and Shah 2013). Throughout this literature, however, with the exception of Arunachalam and Shah (2013), researchers have assumed that this premium reflects a compensating differential for STI risk. This inference is made because the price for unprotected sex increases with STI prevalence. Specifically, Arunachalam and Shah (2013) find that a 1 percentage increase in STI prevalence increases the price premium by 33 percentage

[1] See Figure in the Appendix that uses data from UNAIDS (2010) showing a linear relationship between HIV prevalence among sex workers and the general population.

points. They also find that the anal sex premium is larger than the vaginal sex premium, as do Robinson and Yeh (2011).

Arunachalam and Shah (2013) find a positive relationship between STI prevalence and the price premium for unprotected sex. However, they also find a price premium in places with zero STI prevalence. I build from this result and, in this paper, I introduce a novel source of the price premium that has gone unexplored in the literature. I argue that an alternative source of the price premium is a compensating differential for pregnancy risk. I chart this course because the literature has so far ignored the fact that condoms prevent both STIs *and* pregnancy. Therefore, looking at the differential prices clients pay for unprotected sex may capture not only sex workers' compensating differential for STI risk (if any) but also pregnancy risk. Using a rich dataset from Robinson and Yeh (2011), I test to see whether a compensating differential for pregnancy risk is an alternative source of the price premium for unprotected sex.

I also test whether a compensating differential for STI risk and clients' disutility for condoms explain the price premium for unprotected sex. I test for clients' disutility for condoms because the literature also suggests that regardless of sex workers' risk aversion to STIs (or pregnancy), a price premium for unprotected sex will still be observed because of sex workers' ability to charge clients more because of their disutility for condom use (Arunachalam and Shah 2013). Rao et al. (2003) argues that the price premium for unprotected sex stems from clients' unwillingness to use condoms. Gertler et al. (2005) model the price premium as the result of clients' willingness to pay for and sex workers' willingness to accept unprotected sex, and find that attractive sex workers get about twice the premium for unprotected sex, a measure of bargaining power. The unique contribution of this paper to the literature is the introduction of pregnancy risk as an alternative source of the price premium; using menstrual cycles to directly assign probabilities of pregnancy; and of course the evaluation of all the competing theories of the source of the price premium for unprotected sex.

In testing for the sources of the price premium for unprotected sex, I use innovative measures of STI risk, pregnancy risk, and clients' disutility for condoms.[2] To measure STI risk, I use a dummy variable equal to one for each sexual transaction that occurred with a risky client.[3] To identify the premium associated with STI risk I interact this risky client dummy variable with a dummy variable equal to one for each sexual transaction that occurred without a condom. Together, the interaction of these two variables reflect my measure of the price premium for unprotected sex due to STI risk.

To measure pregnancy risk I interact two variables. The first is a dummy variable equal to one for each sexual transaction that occurred with a sex worker who is not on birth control. This first variable allows me to identify, for sex workers who are not on birth control, how much they charge for sexual transactions. The second is a variable equal to the direct probabilities of pregnancy for each sex worker. This second variable reflects a direct measure of each sex worker's probability of getting pregnant during any sexual transaction.[4] To identify the premium associated with pregnancy risk I interact these variables with a dummy variable equal to one for each sexual transaction that occurred without a condom. Together, these variables allow me to identify, for each unprotected sexual transaction, how much a sex worker charged a client during days when her chances of getting pregnant were non-negligibly above zero.

To measure clients' disutility for condoms, I use a dummy variable equal to one whenever a sexual transaction occurred with a client who likes to have unprotected sex more than the average client. To identify the premium associated with clients' disutility

[2]Further details of all these measures are in Section 3.2.

[3]This variable captures sex workers' subjective beliefs on how risky their clients were. In particular, this dummy variable equals one whenever a sex worker thought the client was at high risk of having HIV/AIDS. Further details can be found in Robinson and Yeh (2011).

[4]I use two measures of probability of pregnancy. The first is simply the direct probabilities for pregnancy for each 28-day menstrual cycle. These direct probabilities come from Wilcox et al. (2001). The second uses these same direct probabilities for the first four days of the menstrual cycle, but 0.165 for the remaining days of menstrual cycle. Details on how 0.165 is obtained can be found in Section 3.2. This measure captures the uncertainty of any sex worker in predicting her probabilities of getting pregnant and thus reflects the stochastic nature of predicting one's probability of pregnancy. Please note that I also interact these probabilities by the number of clients to incorporate the idea that the probability of pregnancy increases with each *marginal* client.

for condoms, I interact this variable with a dummy variable equal to one for each sexual transaction that occurred without a condom. Together, these two variables allow me to identify for each unprotected sexual transaction, how much a client with a disutility for condoms pays.

Using all these measures, I use the probability of pregnancy as an instrument for unprotected sex and run two-stage least-squares (2SLS) regressions and find that a compensating differential for pregnancy risk is the source of the price premium for unprotected sex. The price premium for pregnancy risk is as much as USD 122[5] which is about 16 times average price. The price premium for STI risk is USD 3.3 or 38 percent of average price, but only a *thirty-seventh* or 2.7 percent of the compensating differential for pregnancy risk. Clients' disutility for condoms has a premium as much as USD 0.154 or 1.8 percent of average price but is not statistically signficant.

Section 2 provides motivation and a simple theory as to why compensating differentials for STI risk and pregnancy risk are sources of the price premium for unprotected sex. Section 3 presents the data. The remaining sections introduce the empirical specifications and presents results (Section 4), while the penultimate section presents robustness checks and limitations of my analysis (Section 5), and the final section concludes the paper (Section 6).

2 Motivation and Theory

Although having unprotected sex increases sex workers' risk of STI infection and we should observe them reducing risky sexual behavior (Posner 1992), the price premium for unprotected sex acts to incentivize sex workers towards risky sexual behavior. In an attempt to capture this premium, sex workers are incentivized to instead increase risky

[5] Robinson and Yeh (2011) report that the Kenyan shilling-US dollar exchange rate during sampling was 70 Ksh to the dollar. I use this exchange rate to calculate dollar values throughout this paper to get a sense of these premia in US dollars.

sexual behavior. Sex workers also use the price premium to smooth consumption during idiosyncratic health shocks as well as during and after political conflict (Robinson and Yeh 2011; Dupas and Robinson 2012). Arunachalam and Shah (2013) provide the most compelling and rigorous evaluation of the compensating differential for STI risk as a source of the price premium for unprotected sex. They introduce a simple theoretical framework than incorporates clients' disutility for condoms as well as sex workers' risk aversion to STI transmission. In this paper, I build on Arunachalam and Shah (2013) but instead of a compensating differential for STI risk as a source of the price premium for unprotected sex I argue that a compensating differential for pregnancy risk is the source of the price premium for unprotected sex. Next I introduce my main theoretical framework but before that I explain why we observe STI prevalence increasing with the price premium for unprotected sex.

2.1 STI Risk

In order to explain why the price premium for unprotected sex increases with STI prevalence, we must first remember that condoms prevent both STI and pregnancy. If we assume pregnancy risk aversion and a compensating differential for pregnancy risk as the source of the price premium then we can easily think about a heterogeneous distribution of sex workers so that some sex workers are more or less risk averse than others. In areas with a distribution of disproportionately more risk averse sex workers, the price premium will increase to compensate for this risk aversion. This price premium in turn will incentivize the sex workers to have more unprotected sex and in turn the transmission of STIs will increase causing STI prevalence to increase. Alternatively, in areas with a distribution of disproportionately less risk averse sex workers, the price premium will decrease because sex workers do not need to be compensated for unprotected sex. This price premium in turn will disincentivize the sex workers to have more unprotected sex and in turn the transmission of STIs will decrease causing STI prevalence to decrease.

STI prevalence is not the cause of the price premium for unprotected sex but rather the outcome of it.

Although Arunachalam and Shah (2013) provide argue that a compensating differential for STI risk is the source of the price premium for unprotected sex, they also find that the price premium for unprotected sex is observed in places with zero STI prevalence. Moreover, observing a positive relationship between STI prevalence and the price premium for unprotected sex captures not only increased risk to STIs but also pregnancy. Since condoms exclude the possibility of STI infection as well as pregnancy, the inference that unprotected sex is transacted at a relatively higher price than protected sex as compensation for increased STI risk is far from robust. To resolve this issue, any empirical test of the theory for the compensating differential for STI risk must exclude the possibility of other costs which are also prevented through condom use and which sex workers might potentially wish to avoid, such as pregnancy.

2.2 Pregnancy Risk

Pregnancy introduces several costs to the sex worker including (1) the direct costs of child-rearing, which are non-negative and non-trivial[6]; (2) lost wages during the latter stages of pregnancy and early stages of the child's infancy when the mother's time is almost exclusively used caring for the infant and she is unable to work for wages; and (3) if the sex worker decides to abort, costs of abortion including monetary costs and any health complications that occur as a result of the procedure, both physiological as well as psychic costs.[7] The profit maximizing sex worker would thus engage in unprotected

[6]Important inputs in the rearing of children include food and housing at the most basic level and education at a much higher order level all of which are non-trivially above zero.

[7]Besides these costs, an additional cost might be reduced marriage prospects. Siow (1998) and Edlund and Korn (2002) assume that men prefer to marry women who have no children implying that children might also potentially reduce marriage prospects. Becker (1993) argues that children are seen as capital investment in marriage, and thus the prospect of divorce lowers the accumulation of children and also shows that empirically, divorced women with children remarry more slowly than divorced men. Weitzman and Dixon (1979) argue that young children raise the cost of searching for another mate and reduce the net resources of these mothers. Although all these should push us to believe that sex work

sex if and only if the price premium for unprotected sex is greater than the marginal cost to unprotected sex, i.e. pregnancy risk.

2.3 STI Risk and Pregnancy Risk

To fix ideas, I present a simple expected utility model. I argue more formally and let P_1 be the price received by a sex worker for unprotected sex in the sex market or the price premium; P_2 be the price received by a sex worker for protected sex in the sex market; Q be unprotected sexual transactions by the sex worker in the sex market; g be the probability of getting pregnant (where of course $(0 \leq g \leq 1)$. Let C be all the costs of unprotected sex including pregnancy, including costs of rearing a child from pregnancy to maturity into adulthood and independence or any abortion costs. As such, if the sex worker chooses to supply unprotected sex, her expected utility is defined as follows;

$$gU(P_1Q - CQ) + (1 - g)U(-P_2Q) \tag{1}$$

Notice that the costs to unprotected sex do not feature on the right of the above equation. For simplicity I assume that there are no costs to unprotected sex for sex workers who chose to use condoms.[8] I make Q negative in the protected sex part of the above equation to reflect the fact that sex workers only receive P_2 if they have sex with a condom and have a disutility for receiving P_2 when $Q > 0$. I also assume that all utility

lowers marriage prospects, sex workers in our dataset however, say that sex work has increased their marriage prospects. Although Robinson and Yeh (2011) suggest that sex work might affect marriage prospects on the intensive (partner quality) rather than the extensive (finding a partner) margin, I exclude this possible cost of marriage prospects so to not detract from the general point that pregnancy and its products are costly to sex workers.

[8]Many studies have showed that condoms are highly effective at preventing pregnancy. Davis and Weller (1999) for instance find that the likelihood of pregnancy after protected sexual intercourse is as low as 0.026 and a condom's effectiveness at preventing HIV transmission is estimated to be as high as 96 percent. This simplifying assumption allows me to focus on just the effects of pregnancy risk whenever a condom is not used.

functions are continuous and twice-differential functions.

The sex worker thus has the following maximization problem with respect to unprotected sex, Q;

$$\overset{max}{q} gU(P_1Q - CQ) + (1-g)U(-P_2Q) \tag{2}$$

Subject to some Q and C such that $Q \leq \bar{Q}$ and $C \leq \bar{C}$.[9]

The first order conditions are derived as follows;

$$g(P_1 - C)[U'(P_1Q^* - CQ^*)] - (1-g)P_2[U'(-P_2Q^*)] = 0 \tag{3}$$

This implies the sex worker choses the amount of unprotected sex that maximizes her expected utility in the following way;

$$\frac{U'(P_1Q^* - CQ^*)}{U'(-P_2Q^*)} = \frac{P_2}{P_1 - C}[\frac{1-g}{g}] \tag{4}$$

Further, the second order conditions are derived as follows;

$$g(P_1 - C)^2[U''(P_1Q^* - CQ^*)] + (1-g)(P_2)^2[U''(-P_2Q^*)] \tag{5}$$

Now, before I proceed to look at the sex worker's maximization decision based on different levels of g, let us first look at what the second order conditions allow us to infer. Please note that because I do not *ex ante* impose any risk profiles in my above model, I can explore different effects for different risk profiles.

First, if I assume the sex worker is risk averse so that her second order utility functions are negative ($U'' < 0$) then I can sign each of the terms of her second order conditions

[9] This basically defines some upper limit to unprotected sexual transactions and costs of unprotected sex. There are only so many sexual transactions any one sex worker can have, even in the face of limitless client supply. On the costs of unprotected sex, although one can model even mortality in the wake of supplying sex in the market (unprotected or otherwise), what is important to note is that costs are not without bound.

in the following manner[10]:

$$\underbrace{\underbrace{g}_{\text{+ve}}\underbrace{(P_1-C)^2}_{\text{+ve}}\underbrace{[U''(P_1Q^*-CQ^*)]}_{\text{-ve}}+\underbrace{(1-g)}_{\text{+ve}}\underbrace{(P_2)^2}_{\text{+ve}}\underbrace{[U''(-P_2Q^*)]}_{\text{-ve}}}_{\text{-ve}} \tag{6}$$

which means that the whole equation becomes negative thus indicating that the solution of the first order conditions will identify a *maximum* level of unprotected sex that will maximize a sex worker's utility.

Similarly, if I assume the sex worker is risk preferring so that her second order utility functions are positive ($U'' > 0$) then I can sign each of the terms of her second order conditions in the following manner[11]:

$$\underbrace{\underbrace{g}_{\text{+ve}}\underbrace{(P_1-C)^2}_{\text{+ve}}\underbrace{[U''(P_1Q^*-CQ^*)]}_{\text{+ve}}+\underbrace{(1-g)}_{\text{+ve}}\underbrace{(P_2)^2}_{\text{+ve}}\underbrace{[U''(-P_2Q^*)]}_{\text{+ve}}}_{\text{+ve}} \tag{7}$$

which means that the whole equation becomes positive thus indicating that the solution of the first order conditions will identify a *minimum* level of unprotected sex that a sex worker will chose. In a distribution of sex workers in any given sex market, there are bound to be both risk averse sex workers as well as risk preferring sex workers. One can imagine an equilibrium where there are enough of both risk profiles among sex workers so as to cancel either type's effects on prices. This would only be true if there existed no price premium for unprotected sex. So, moving forward, I assume that sex

[10]Note that g and $(1-g)$ are bounded by zero and one and are thus positive; both $(P_1-C)^2$ and $(P_2)^2$ are squares of some entity and thus must also be positive; and lastly $U''(P_1Q^*-CQ^*)$ and $U''(-P_2Q^*)$ are negative by the assumption of risk aversion.

[11]Once again, g and $(1-g)$ are bounded by zero and one and are thus positive; both $(P_1-C)^2$ and $(P_2)^2$ are squares of some entity and thus must also be positive; and lastly $U''(P_1Q^*-CQ^*)$ and $U''(-P_2Q^*)$ are positive by the assumption of risk preference.

workers are risk averse and that the following analysis allows us to think about what level of unprotected sex maximizes a sex worker's utility.[12]

Now, recall that the first order conditions derived the following equality:

$$\frac{U'(P_1Q^* - CQ^*)}{U'(-P_2Q^*)} = \frac{P_2}{P_1 - C}[\frac{1-g}{g}] \tag{8}$$

So that I can make the following propositions, but before I do I assume the following:

- Utility increases with prices or $\frac{\partial U}{\partial P_i} > 0$ where i is either equal to one or two.
- Utility increases with unprotected sexual transactions or $\frac{\partial U}{\partial Q} > 0$
- Utility decreases with costs of pregnancy or $\frac{\partial U}{\partial C} < 0$
- And finally, conditional on getting pregnant costs of pregnancy are constant across levels of unprotected sex.

2.4 Proposition and Implications

Proposition: The price for unprotected sex decreases and increases with the probability of pregnancy but only through probability of pregnancy's effect on unprotected sex.[13]

As the probability of pregnancy decreases, sex workers can easily increase their utility by increasing unprotected sex avoiding any costs associated with unprotected sex. So for any sex worker who is experiencing probabilities of pregnancy that are trivially low in any given day, she would be willing to have unprotected sex for a lower price than during days that she is experiencing non-trivially high probabilities of pregnancy. Conversely, for any sex worker who is experiencing probabilities of pregnancy that are *non-trivially*

[12] The third risk profile—risk neutral—does not provide any meaningful predictions of a minimum or a maximum because the second order conditions in this case are zero.

[13] All Proofs in Appendix C.

high in any given day, she would only be willing to have unprotected sex if she were compensated for the risk of pregnancy with a relatively higher price for unprotected sex. Because as the probability of pregnancy increases sex workers can easily increase utility through reducing unprotected sex, the only way to reverse this and induce sex workers to have unprotected sex is to have the price for unprotected sex increase as compensation for pregnancy risk. The prediction of this model and its proposition is that we will empirically observe the price for unprotected sex increasing with the probability of pregnancy *through* the effect the probability of pregnancy has on women's willingness to supply unprotected sex. As a result, holding the price for *protected* sex constant, the price premium for unprotected sex will increase with the probability of pregnancy. Results of this paper are consistent with this simple prediction, but before I present those results, Sections 3 and 4 introduce the data and the empirical specifications.

3 Data and Summary Statistics

3.1 Data

The dataset is from Robinson and Yeh (2011)[14] and includes background information and self-reported information by 192 sex workers reporting on 19,041 sexual transactions in 12,536 sex worker days. A random sample of 248 women were selected to be a part of the study from 1,205 women identified. Of these 248 women, only 192 women had complete and usable data. Of these 56 that did not constitute the final sample, 7 refused to participate at all, and the remaining 49 either did not complete the study or had unusable reported data. Robinson and Yeh (2011) report that these 49 attrited women are not statistically different along most background characteristics as those who remained in the study. Data collection occurred between October 2005 and October 2006. A baseline survey collected background information on the women, and all women were

[14]More details on this dataset can be found on pages 39-43 from Robinson and Yeh (2011).

asked to keep and record sexual transactions through provided diaries. The women were compensated with paid cash for keeping these diaries. The women were asked to provide detailed information about the sexual transactions with clients (up to a maximum of three transactions per day). To avoid losing illiterate women in the sample, efforts were made to help these women fill in the diaries, however literacy in the sample was relatively high with 95 percent and 88 percent of sampled women being able to read and write Kiswahili, respectively.[15]

3.2 Measuring Pregnancy Risk, STI Risk, and Clients' Disutility for Condoms

In order to measure pregnancy risk, STI risk, and clients' disutility for condoms, I interacted several variables from the Robinson and Yeh (2011) dataset.

3.2.1 STI Risk

To measure STI risk, I use a dummy variable equal to one for each sexual transaction that occurred with a risky client. To identify the premium associated with STI risk I interact this risky client dummy variable with a dummy variable equal to one for each sexual transaction that occurred without a condom. Together, the interaction of these two variables reflect my measure of the price premium for unprotected sex due to STI risk.

3.2.2 Pregnancy Risk

To measure pregnancy risk I interact two variables. The first is a dummy variable equal to one for each sexual transaction that occurred with a sex worker who is not on birth control. This first variable allows me to identify, for sex workers who are not on birth control, how much they charge for sexual transactions. The second is a variable

[15]See Table 7.1.

equal to the direct probabilities of pregnancy for each sex worker. This second variable reflects a direct measure of each sex worker's probability of getting pregnant during any sexual transaction. I use estimated probabilities of pregnancy from Wilcox et al. (2001) and Wilcox et al. (1995). Wilcox et al. (2001) calculate estimated mean probabilities of clinical pregnancy for each day of a woman's menstrual cycle[16] while Wilcox et al. (1995, p. 1519) provide probabilities of pregnancy for a woman who has unprotected sexual intercourse everyday (0.37), every other day (0.33), and once per week (0.15).

Before assigning probabilities of pregnancy, however, I first must have information on the exact day a sex worker is in her menstrual cycle. To map menstrual days to each sex worker's sexual transactions on any given day, I use two variables from the Robinson and Yeh (2011) dataset. The first is a dummy variable equal to one whenever a sex worker reports having menstruated the day *of* the sexual transaction. The second is a dummy variable equal to one whenever a sex worker reports having menstruated the day *before* the sexual transaction. Using these two variables I code the first day of a sex worker's menstrual cycle whenever the sex worker having menstruated the day *of* but not the day *before* the sexual transaction. I then loop 28-day menstrual cycles across all sex workers and sexual transactions.[17] After mapping menstrual cycles I then assign direct probabilities of pregnancy to each menstrual day using the Wilcox et al. (2001) day-specific probabilities of clinical pregnancy. A second probability of pregnancy measure incorporates sex workers' uncertainty of their menstrual cycle. In this second measure, I assign direct probabilities of pregnancy using the Wilcox et al. (2001) day-specific probabilities of clinical pregnancy only for the days during a sex worker's menses (days one to four). The remaining days I interact two variables. The first is the probability of pregnancy (0.33)[18] following unprotected sexual intercourse every other day reported in

[16] Table 1 on page 213 of Wilcox et al. (2001) presents these estimates.

[17] Other economists have also used 28-day cycles when using women's menstrual cycles, such as Ichino and Moretti (2009) who use women's menstrual cycles as an instrument for employment days.

[18] I use this probability because about 81 percent of sex workers in the sample had sexual intercourse *each* day and so this is a lower bound estimate of the chances of these women getting pregnant given

Wilcox et al. (1995). The second is the natural probability of a sex worker being in her fertile period. This is calculated by observing that her fertile period lasts 12 days[19] and given that we have mapped her first 4 days, her remaining *unmapped* days total 24. So 12/24 (or 0.5) is her natural probability of being on a day within her fertile period. So, multiplying 0.5 and 0.33, I get 0.165, which I assign to menstrual days after the 5th day across all sex workers.

For any missing values I assign the probability of pregnancy of 0.165 for reasons described above. I also interact both probability of pregnancy measures with the number of clients that the sex worker transacted sex with. I do this because for each sex worker, having multiple sexual partners will increase their probabilities of pregnancy for that day because the potency of sperm would only have decreased if sexual intercourse occurred with the same client during that particular day (MacLeod and Gold 1953; Freund 1962; Poland et al. 1985).

To identify the premium associated with pregnancy risk I interact both my probability of pregnancy measures with a dummy variable equal to one for each sexual transaction that occurred without a condom. Together, these variables allow me to identify, for each unprotected sexual transaction, how much a sex worker charged a client during days when her chances of getting pregnant were non-negligibly above zero.

their relatively high sexual activities. More importantly, although frequent sexual intercourse affects the potency of sperm (MacLeod and Gold 1953; Freund 1962; Poland et al. 1985), these sexual transactions did not necessarily occur with the same clients. In fact, only 17 percent of transactions, on average, in the dataset occurred with regular clients, while on the other hand, over 64 percent of transactions, on average, occurred with casual clients. It is also important to note that Dunson et al. (1999), in re-evaluating Wilcox et al. (1995)'s estimates, revises those estimates to as high as 0.42. Both these points are important to keep in mind because the probability of pregnancy I use here for these women (sex workers) constitutes a conservative estimate of their actual probabilities of pregnancy.

[19] A woman's fertile period is from days 8 to 19 of her menstrual cycle (Beads 2013). Please also note that this fertile window period incorporates a woman's ovulation cycle and sperm life within a woman's body and that around 80 percent of women fall within this fertile window because they typically have 26-32 day menstrual cycles (University 2013).

3.2.3 Clients' Disutility for Condoms

Finally, to measure clients' disutility for condoms, I use a dummy variable equal to one whenever a sexual transaction occurred with a client who likes to have unprotected sex more than the average client. To identify the premium associated with clients' disutility for condoms, I interact this variable with a dummy variable equal to one for each sexual transaction that occurred without a condom. Together, these two variables allow me to identify for each unprotected sexual transaction, how much a client with a disutility for condoms pays..

3.3 Summary Statistics

Summary statistics are presented in Tables 1-3 in the Appendix. The average sex worker in the sample is 28 years old, started sex work when she was around 19 years old, has 2 children, and has completed over nine grade years of education.[20] Forty-four percent of sex workers in the sample have never been married, while twenty-three and twenty percent of sex workers in the sample have been widowed or divorced, respectively. Ninety percent of the sampled women come from the Luo and Luhya tribes.

Table 7.1 here.

The women in the sample are well informed about the risks related to HIV/AIDS, as demonstrated by the fact that the average woman in the sample scored 94 out of 100 on a test of HIV knowledge. The test evaluated knowledge on HIV transmission, risk reduction methods, and misconceptions surrounding HIV/AIDS. Women in the sample earn more money from sex work than from other activities. The average woman in the sample earns 851 Ksh (USD 12) a day from over 7 hours of sex work, for an hourly wage rate of about 152 Ksh (USD 2). Alternatively, the average woman earns just 106 Ksh

[20]The education level of the sex workers in the sample is similar to that of the average Kenyan woman (Robinson and Yeh 2011).

(USD 1.5) per day from other work over an 8 hour day, for a daily wage rate of about 41 Ksh (USD 0.6). Sex workers in this sample are similar to other sex worker samples from other studies in this regard because the average sex worker typically earns more than a similar woman with similar demographics in the general population (Edlund and Korn 2002; Gertler et al. 2005; Arunachalam and Shah 2013).

Table 7.2 here.

The data also provides very detailed information on all the 3,656 clients. Nine percent of clients are considered poor[21] and about twenty-seven percent are government employees. Nineteen percent work as truck drivers and another nineteen percent businessmen. Forty-nine percent are from the Luhya and Luo tribes. Fourteen percent are from the Kikuyu tribe, while six percent and four percent are Somalis and Ugandans, respectively. Sixty-two percent and fifty-four percent of clients are considered clean and handsome, respectively. A quarter of clients are uncircumcised, and forty-six percent are considered at high risk of HIV/AIDS. Forty-five percent of clients have some disutility for condoms.

Eight percent of sex workers reported having vaginal sex without a condom. Three percent of sex workers report having some STI and an equal percentage report having unprotected vaginal sex with a client at high risk of HIV/AIDS. Sixty percent of sex workers are on birth control. The average woman received 510 Ksh (USD 7.3) for each sexual transaction. Figure 3.3 shows that the average price for each unprotected vaginal sexual transaction is 604 Ksh (USD 8.6), while each vaginal sexual transaction with a condom is 550 Ksh (USD 7.9), providing suggestive evidence that there is a price premium for unprotected sex consistent with the literature.

Table 7.3 here.

[21] Details on what constitutes *poor* can be found in Robinson and Yeh (2011).

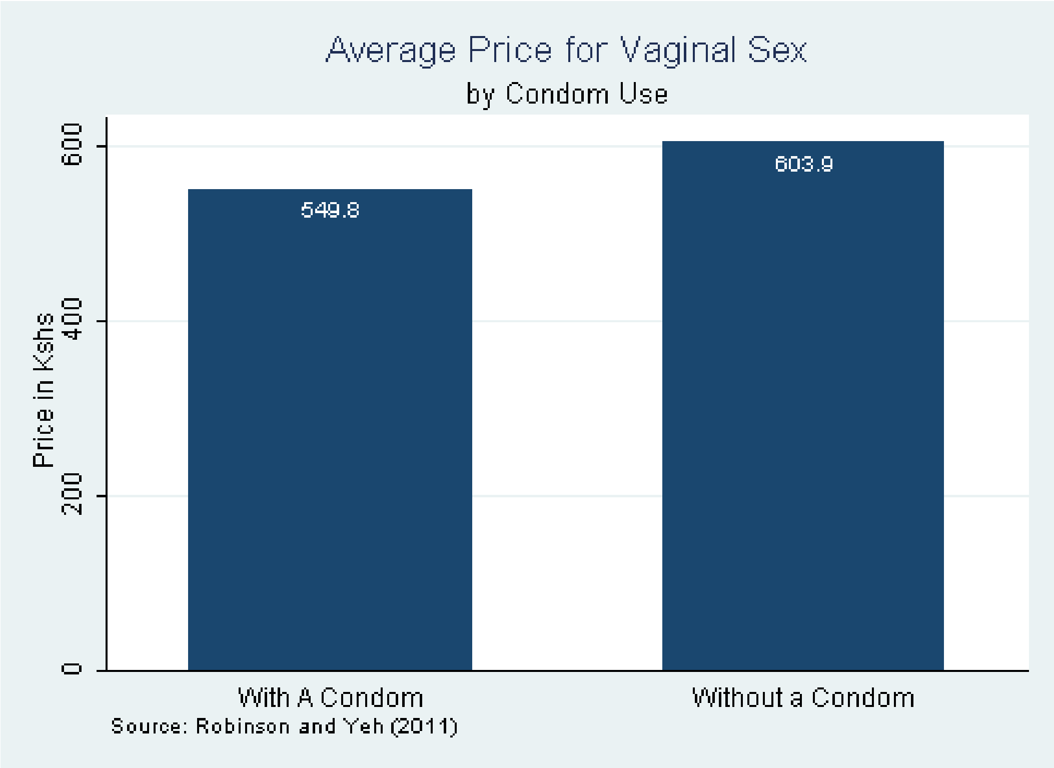


Figure 1: Price Premium for Unprotected Sex.

4 Empirical Specifications and Results

4.1 Specification

To test whether a compensating differential for pregnancy risk is the source of the price premium for unprotected sex I use the probability of pregnancy as an instrument for unprotected sex, as my model predicts, and estimate a two-stage least squares (2SLS) regression. The first stage specification is presented below in equation (1) for the rth transaction for the ith sex worker at the tth date that includes sex worker controls, γ_{irt}^{s} and client controls, ω_{irt}.[22] The time fixed effect τ_t[23] will pick up time-varying effects on prices, such as day-specific demand changes. Finally, ϵ_{irt} is an idiosyncratic error term.

[22]Sex worker-controls include sex workers' age, experience, years of education, literacy, tribe, marital status, and number of own children. I also control for whether clients are regular, risky, clean, wealthy, handsome, occupation, ethnicity and for their disutility for condoms.

[23]The time fixed effects are simply day and month dummies.

In all specifications standard errors are clustered at the sex worker level.[24]

The first stage regresses unprotected sex on the probability of pregnancy as follows;

$$NC_{irt} = \beta_0 + \beta_1 PP + \sum_{s=1}^{S} \beta^s \gamma^s_{irt} + \sum_{c=1}^{C} \beta^c \omega^c_{irt} + \tau_t + \epsilon_{irt} \tag{1}$$

where *NC* or *No Condom* is a dummy variable equal to one when a condom is not used during vaginal sex and *PP* or *Probability of Pregnancy* is the direct measure of clinical pregnancy for each sexual transaction[25]. Because the theoretical framework predicts that the price premium will increase with the probability of pregnancy ($\frac{\partial P_1}{\partial g} > 0$) but only through reduced unprotected sex ($\frac{\partial Q}{\partial g} < 0$) we should expect $\beta_1 < 0$.

The second stage regresses price on the instrumented *NC* with sex worker and client controls, as well as the time fixed effects as follows:

$$\begin{aligned} P_{irt} =& \beta_0 + \beta_1 \widehat{NC} + \beta_2 NB + \beta_3 (NC \times NB) + \beta_4 (NC \times PP) + \beta_5 (PP \times NB) + \\ & \beta_6 (NC \times PP \times NB) + \sum_{s=1}^{S} \beta^s \gamma^s_{irt} + \sum_{c=1}^{C} \beta^c \omega^c_{irt} + \tau_t + \epsilon_{irt} \end{aligned} \tag{2}$$

where *NB* or *No Birth Control* is a dummy variable equal to one for a sex worker who is not on birth control; $NC \times NB$ is the interaction between *No Condom* and *No Birth Control*; $NC \times PP$ is the interaction between *No Condom* and *Probability of Pregnancy*; $PP \times NB$ is the interaction between the *Probability of Pregnancy* and *No Birth Control*; and of course $NC \times PP \times NB$ is the interaction between *No Condom*, the *Probability of Pregnancy*, and *No Birth Control*. Once again, because the theoretical framework predicts that the price premium will increase with the probability of pregnancy ($\frac{\partial P_1}{\partial g} > 0$)

[24] Running all the models by clustering standard errors at the sex worker level, to account for the fact that errors are likely correlated for a particular sex worker is consistent with Robinson and Yeh (2011), while Arunachalam and Shah (2013) cluster at the sex worker city location level.

[25] Recall that I use two measures of pregnancy risk. For further details see Section 3.2.2.

but only through reduced unprotected sex ($\frac{\partial Q}{\partial g} < 0$) we should expect $\beta_6 > 0$.

The identifying assumption is that the probability of pregnancy exogenously predicts whether a sex worker decides to have unprotected sex and that this is uncorrelated with anything else in the structural equation's error term, ϵ_{irt}. If these assumptions hold and a relationship between pregnancy risk and the price premium for unprotected sex is identified, then β_6 will reflect a compensating differential for pregnancy risk as the source of the price premium for unprotected sex in specification (1).

In a final specification, I test my pregnancy risk against the other competing sources of the price premium for unprotected sex. I estimate the same 2SLS specification but include variables that estimate a compensating differential for STI risk and clients' disutility for condoms. I do not present the first stage results because they remain the same for this specification. Specifically, I estimate the following second stage model:

$$\begin{aligned} P_{irt} = &\beta_0 + \beta_1 \widehat{NC} + \beta_2 NB + \beta_3 (NC \times NB) + \beta_4 (NC \times PP) + \beta_5 (PP \times NB) + \\ &\beta_6 (NC \times PP \times NB) + \beta_7 RL + \beta_8 (RL \times NC) + \beta_9 DC + \beta_{10} (DC \times NC) + \\ &\sum_{s=1}^{S} \beta^s \gamma_{irt}^s + \sum_{c=1}^{C} \beta^c \omega_{irt}^c + \tau_t + \epsilon_{irt} \end{aligned} \tag{3}$$

where *RL* or *Risky Client* is a dummy variable equal to one for a client whom the sex worker reports as being at high risk of HIV/AIDS; and of course $RL \times NC$ is the interaction between the two;*DC* or *Clients' Disutility for Condoms* is a dummy variable equal to one for a client whom the sex worker reports as having more unprotected sex than the average client; and ff course, $DC \times NC$ is the interaction between *Clients' Disutility for Condoms* and *No Condom.*

4.2 Results

Before presenting results, I will discuss why my identifying assumptions hold.

To test the identifying assumption that probability of pregnancy is correlated with unprotected sex, I test whether it is a weak instrument for unprotected sex. The null hypothesis is that the two measures of probability of pregnancy are weak instruments for unprotected sex. For the first measure, I reject the null hypothesis at the one percent level of significance. The R-Squared (0.649) is fairly high and the F-Statistic (18.771) is also above the conventional level of 10. Similarly testing whether my second probability of pregnancy measure is a weak instrument for unprotected sex, I reject the null hypothesis of it being a weak instrument at the one percent level of significance. The R-Squared (0.829) is fairly high and the F-Statistic (12.092) is also above the conventional level of 10.

To test the second identifying assumption that the probability of pregnancy is uncorrelated with anything in the error term ϵ_{irt} first note that there is nothing that can control a woman's menstrual cycle, the least of which the woman herself. However, the biggest threat to this second identifying assumption is whether anyone— clients in particular— can discern when a woman is in her fertile period. In an innovative study, Miller et al. (2007) show that lap dancers who are not on any contraceptive earn more during the menstrual cycle, this difference peaking during the fertile period of the cycle when her probability of pregnancy is highest.

The mechanism they propose for their results is that during fertile periods, the lap dancers somehow *signal* or *leak* cues of their fertility status and male customers are influenced to spend more.[26] If clients find sex workers more attractive during peak fertile periods and sex workers can somehow signal this (or clients can somehow observe this) then attractiveness would be correlated with probability of pregnancy and in turn predict prices violating the exclusion restriction so that $cov(g, \epsilon_{irt}) \neq 0$. To test whether sex workers can effectively signal their peak fertile periods and/or clients can effectively discern this period, I regress a dummy variable that indicates whether a sex worker is

[26]For an interesting discussion on this see pages 379-380 from Miller et al. (2007).

on her fertile period on client characteristics and find no relevant[27] characteristic that significantly correlates with a sex worker's fertile period and find it difficult to reject that the exclusion restriction does not hold.

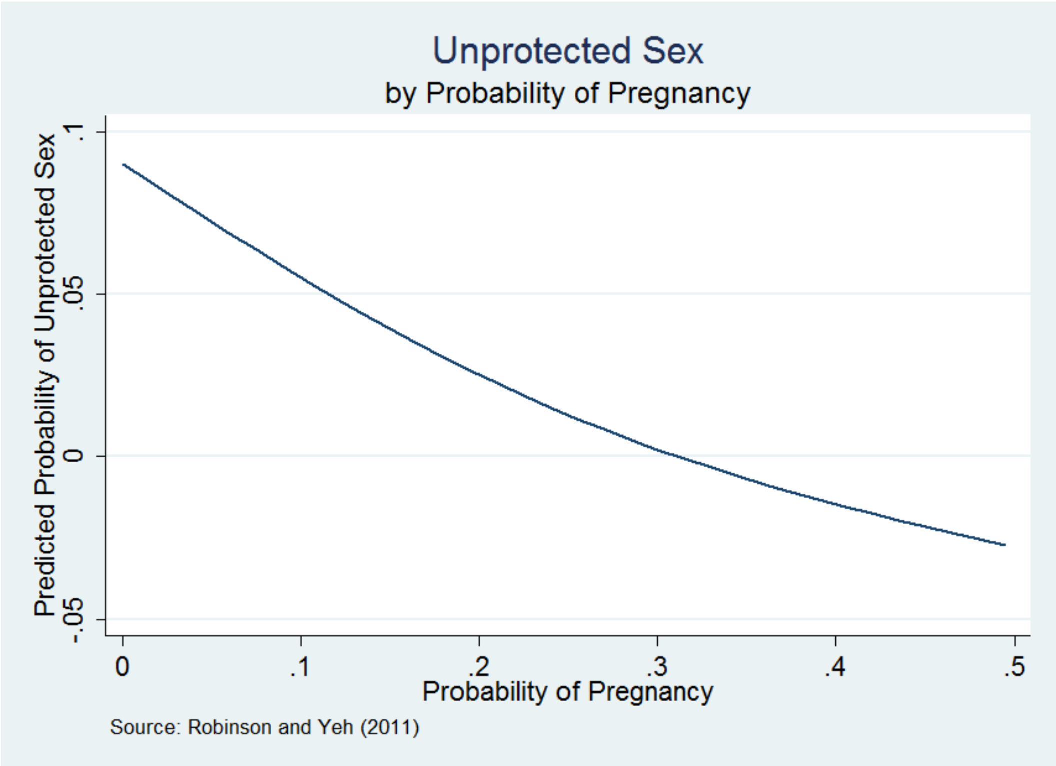


Figure 2: First Stage Regression with Second Measure of Pregnancy.

Reduced-form regression results are represented graphically in Figure 4.2. The predicted probability of having unprotected sex decreases as the probability of pregnancy increases, as predicted by the model. The figure presents only for the second measure of my probability of pregnancy, however, a similar figure for the first measure of my

[27]The dummy variable that indicates whether a client is from the Kamba tribe does statistically correlate with a sex worker's fertile period. Specifically, Kamba clients are less likely to have sex with a sex worker when she is on her fertile period. Since Miller et al. (2007) show male preference for women during fertile periods by their increased willingness to pay more, this negative relationship between Kamba clients and sex workers' fertile periods should actually push prices *down* and so this paper's identified estimates of the compensating differential for pregnancy risk is a lower bound for Kamba clients. Results of this exercise are not show, but available upon request.

probability of pregnancy exhibits a similar negative relationship between the probability of pregnancy and the predicted probability of having unprotected sex.

Reduced-form regression results of the first stage estimations are reported in columns (1-2) of table 7.4. Coefficients on both measures of probability of pregnancy are statistically significant at the one percent level of significance and both are of the expected sign. For each percent increase in the probability of pregnancy sex workers are between 35 percent and 125 percent less likely to have unprotected sex.

Main results are presented in Table 7.5. Columns (1), (3), and (5) present the second stage specification for my first probability of pregnancy measure while columns (2), (4), and (6) present results for my second measure. Columns (1-2) present a parsimonious version of equation (2) that include no controls, while columns (3-4) include only time dummies and sex worker controls and finally, columns (5-6) include all controls—time dummies, sex worker and client controls. Sex workers who have unprotected sex, after instrumenting with the probability of pregnancy, earn anywhere between Ksh 612 (USD 8.7) and Ksh 840 (USD 12) which is about 1.1 to 1.5 times average price.

The coefficient β_6 that identifies the price premium for unprotected sex due to a compensating differential for pregnancy risk is the one that has all the interactions $NC \times NB \times PP$ and it varies from Ksh 1,787 (USD 25.5), which is statistically significant at the ten percent level, to Ksh 7,588 (USD 108.4), which is statistically significant at the five percent level. These point estimates imply that sex workers who are not on birth control and who face increasing probabilities of pregnancy get compensated between 3.3 to 13.9 times average price to have unprotected sex. Adding controls does not change statistical significance except for my second probability of pregnancy measure which becomes insignificant when time dummies and sex worker controls are added in column (4). The compensating differential for pregnancy risk ranges from Ksh 1,522 (USD 21.7) in column (6) to Ksh 8,569 (USD 122) in column (3). These ranges constitute being compensated 2.5 to 15.8 times the average price.

Results from including a test for a compensating differential for STI risk and clients' disutility for condoms are presented in Table 7.6. Columns (1), (3), and (5) present the second stage specification for my first probability of pregnancy measure while columns (2), (4), and (6) present results for my second measure. Columns (1-2) present a parsimonious version of equation (3) that include no controls, while columns (3-4) include only time dummies and sex worker controls and finally, columns (5-6) include all controls—time dummies, sex worker and client controls.

None of the competing sources of the price premium for unprotected sex are statistically significant at conventional levels in all columns except (5-6). In column (5), the coefficient on the pregnancy risk premium is Ksh 5,731 (USD 82) or 9.5 times average price and statistically significant at 10 percent. The coefficient on the STI risk premium in the same specification is Ksh 76 (USD 1.1) or 13 percent of average price but not statistically significant at 10 percent. In column (6), the coefficients on the pregnancy and STI risks are both statistically significant at the 10 percent level. The STI risk premium is Ksh 230 (USD 3.3) or 38 percent of average price while the pregnancy risk premium is Ksh 1,595 or almost 3 times average price and about 7 times the premium for STI risk.

5 Heterogeneity, Robustness and Limitations

5.1 Heterogeneity

Before I present robustness results and limitations of the empirical estimation of my theoretical model, I present below two heterogeneity analyses. I estimate my main specification from equation (2) again with all controls, then estimate this specification for sex workers who are below the average age of 28.43 years old and also for sex workers who have more than the average number of own biological children of 2.06. Table 7.9 presents results from that analysis, but I leave out the first stage because it remains the same as in the full model presented earlier. Columns (1), (3), and (5) present the second stage specification for my first probability of pregnancy measure while columns (2), (4), and (6) present results for my second measure. Columns (1-2) present the full version of equation (2) that include all controls, while columns (3-4) is the full model but for sex workers who are below the average age of 28.43 years old and finally, columns (5-6) is the full model but for sex workers who have more than the average 2.06 own biological children.

Sex workers who are younger than the average age of the typical sex worker in the sample are compensated between Ksh 2,511 (USD 35.87) and Ksh 6,002 (USD 85.74), which is between 1.57 to 1.05 times, respectively, the compensation for the full sample. Both coefficients are statistically significant at 10 percent. This result is intuitive because younger sex workers should be more likely to be fertile and thus need to be more compensated for pregnancy risk if they are to have unprotected sex.[28] There is no heterogeneity among women who have above the average 2.06 own biological children relative to the full sample.

5.2 Robustness

Because sex workers who are not on birth control can be different in ways that could affect fertility and therefore affect their ability to charge more for unprotected sex, my main IV estimation would be estimating a spurious relationship between pregnancy risk and price. Sex workers on birth control, for instance, could be younger and more attractive. Recall that in my main results I control for sex worker characteristics including age, for instance. I do not have a variable that captures attractiveness, but in a regression of age, experience, education, literacy, ethnicity, marital status and parity, on birth control status, I find only education is a statistically significant predictor of birth control

[28] Declining reproductivity of women as they age is widely documented. A great summary of this can be found in Dunson et al. (2002) where they document that women's fertility begins to decline in the late 20s with substantial decreases by the late 30s. Please note they also find that men's fertility is largely unaffected by age, but with substantial declines by late 30s.

status.[29] Specifically, less educated sex workers are less likely to have birth control. If we think a lack of education also reduces a sex worker's bargaining power in negotiating for higher prices for unprotected sex then this paper's results constitute a lower bound of the estimated effect of pregnancy risk on the price premium for unprotected sex.

Of course, there could still be sex worker characteristics that are unobserved and hence omitted that affect prices in ways that can be correlated with birth control status, for instance. Estimating a specification that includes a sex worker fixed effect α_i will solve this problem by accounting for differences across sex workers in attractiveness (bargaining power) and risk preferences, for instance. I run a sex worker and time fixed effects model[30] to account for this as follows below:

$$
\begin{aligned}
P_{irt} = &\beta_0 + \beta_1 NC + \beta_2 PP + \beta_3 (PP \times NB) + \beta_4 (NC \times NB) + \beta_5 (NC \times PP) + \\
&\beta_6 (NC \times PP \times NB) + \sum_{s=1}^{S} \beta^s \gamma^s_{irt} + \sum_{c=1}^{C} \beta^c \omega^c_{irt} + \alpha_i + \tau_t + \epsilon_{irt}
\end{aligned} \tag{4}
$$

This is a similar regression as the main regression with two exceptions. First, this specification does not exclude the probability of pregnancy. Secondly, and most obviously, because it is a sex worker fixed effects model it drops the *NB* or *No Birth Control* term. Results of this specification are presented in Table 7.7. Once again columns (1), (3), and (5) present the sex worker fixed effects specification using my first probability of pregnancy measure while columns (2), (4), and (6) present results for my second measure. Columns (1-2) present a parsimonious version of equation (4) that include no controls, while columns (3-4) includes only time dummies and sex worker controls and finally, columns (5-6) include all controls—time dummies, sex worker and client controls.

Results show that the coefficient that corresponds to β_6 in the above specification are

[29] Results not shown, but available upon request.

[30] This fixed effects specification is consistent with the literature. Robinson and Yeh (2011) includes a sex worker fixed effect as well as time dummies, while Arunachalam and Shah (2013) include just a sex worker fixed effect.

all not statistically significant. The coefficient of β_6 ranges from Ksh 107.7 (USD 1.5) in column (2) to Ksh 512 (USD 7.3) in column (5) and is negative in column (1). Interpreting these results, the reader can either take them wholesale and conclude that this paper identifies a spurious relationship between pregnancy risk and the price premium for unprotected sex or cautiously see this paper's results as suggestive of pregnancy risk's effect on the price premium for unprotected sex.

It is, however, important to recall that there are no observable statistical differences among women who have birth control and those who do not, except in their levels of education. Even on that difference, it can be argued the effect would have negated a positive price differential between women without birth control and those without it indicating that in fact pregnancy risk's effect on the price for unprotected sex is a lower bound estimate. Additionally, because sex workers are not using and discontinuing birth control use throughout each menstrual cycle, birth control is dropped in the fixed effects model, excluding an important parameter. Further, the fixed effects models at best explain about 3.5 percent of the variation in the price for sex, while my main 2SLS models explain as much as 18 percent or six times that of the fixed effects models. Further, the fixed effects specification is not supported by my theoretical model that argues for the probability of pregnancy being an instrument for unprotected sex.

Further, I run a linear regression model regressing price with pregnancy risk, controlling for unprotected sex, risky clients, STI risk, and all other sex worker, client, and time controls, clustering standard errors at the sex worker level. I then predict prices conditional on all of these observables; plot these predicted prices along my probability of pregnancy dimension, for sex workers with birth control and those without birth control. Ideally, I would observe predicted prices conditional on all the aforementioned, for sex workers without birth control, be higher than predicted prices for sex workers *with* birth control. Figure 5.2 presents results from that exercise.[31] As the figure shows, prices

[31] This figure includes only for my first measure of probability of pregnancy. A figure using my second measure of probability of pregnancy offers a similar picture.

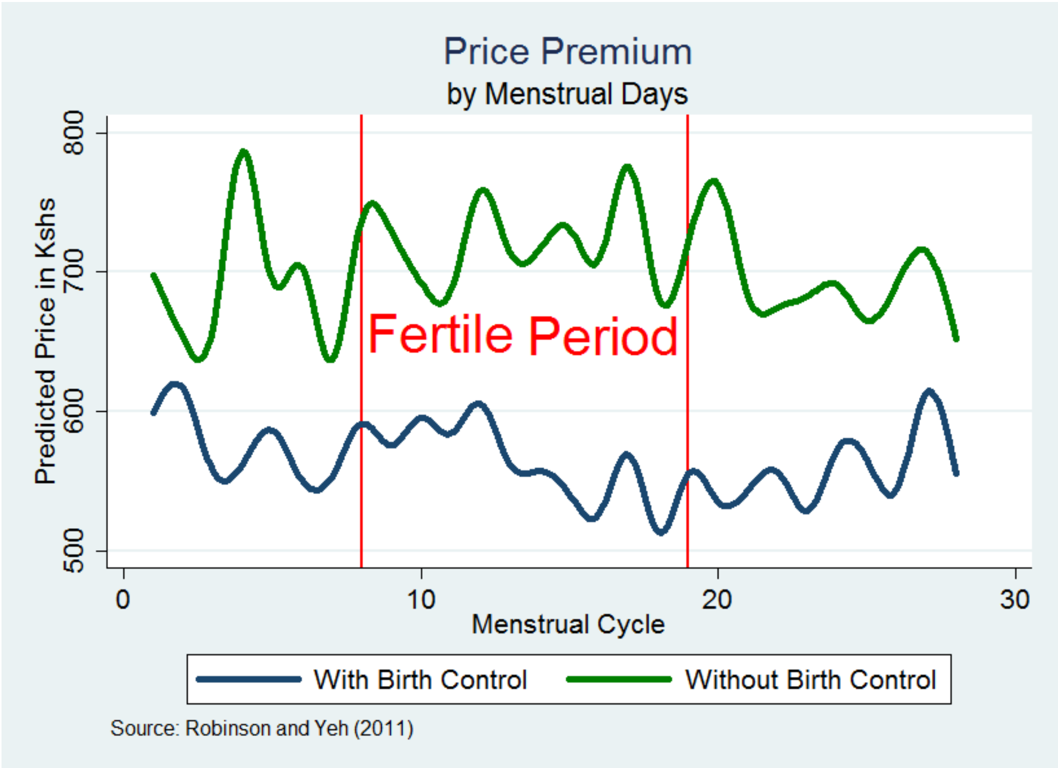


Figure 3: Conditional Predicted Price by Birth Control Across Menstrual Cycle.

paid for vaginal sex are higher for sex workers without birth control and this gap widens around the fertile period of a woman's menstrual cycle (days 8 to 19). Importantly, the first four days of the menstrual cycle when the sex worker is on her menses, prices converge slightly so that there are no differences in prices received by sex workers with or without birth control. Further, no where in the cycle do the prices received by sex workers with birth control intersect with prices received by sex workers without birth control.

I also run a placebo test with my main specification controlling for STI risk and clients' disutility but only on sex workers *with* birth control. The first stage remains the same but the second stage is as follows:

$$
\begin{aligned}
P_{irt} =& \beta_0 + \beta_1 \widehat{NC} + \beta_2(NC \times PP) + \beta_3 RL + \beta_4(RL \times NC) + \beta_5 DC + \beta_6(DC \times NC) + \\
& \sum_{s=1}^{S} \beta^s \gamma_{irt}^s + \sum_{c=1}^{C} \beta^c \omega_{irt}^c + \tau_t + \epsilon_{irt}
\end{aligned} \tag{5}
$$

for $NB = 0$.

If there exists no compensating differential for pregnancy risk, then the coefficient β_2 on this main pregnancy risk variable will not have any predictive power on price because we should not expect sex workers who are on birth control to worry about pregnancy risk. Table 7.8 presents the results from this estimation. The coefficient $beta_2$ is the one with the interaction between NC and PP and constitutes the pregnancy risk premium. Table 7.8 presents results of the placebo test for both probabilities of pregnancy measures (Column 1-2). Both coefficients are negative and not statistically significant at 10 percent.

Table 7.8 here.

5.3 Limitations

The risky client variable is subjective and given measurement error, this variable could be suffering attenuation bias.[32] To try to solve for this I also run an instrumental variable estimation that uses the uncircumcised status of clients as an instrument for STI risk. This estimation allows me to test for endogeneity of my STI risk variable, thus providing greater confidence that the relationship between STI risk and the price premium for unprotected sex is identified. I exploit the fact that a sexual transaction

[32] Recent work by Delavande and Kohler (2012) show that perceptions of not only one's HIV status but also one's spousal HIV status is important in driving one's sexual behavior and perceptions may defer with actual probabilities, with differential effects on behavior. In the case of commercial sex, the effects of perceptions are even more salient given the transient nature of certain clients, providing little information for sex workers to base their perceptions of client risk.

with an uncircumcised men is *external* to the sex worker's choice.[33] I also exploit the fact that uncircumcised men are more likely to get infected with HIV/AIDS, among other STIs,[34] in order to remove any endogenous variation in the risky client variable by using uncircumcised clients as an instrument for risky clients. Results of this 2SLS specification rejects a compensating differential for STI risk as the source of the price premium for unprotected sex.[35]

To be fair, the uncircumcised status of clients is a weak instrument for risky clients and more over, there is evidence to suggest the exclusion restriction does not hold because who is and is not circumcised might be related to ethnicity and other factors that could be related to prices paid. When I run a simple linear regression expressing client characteristics as statistically significant predictors of circumcision I find that indeed being a Luo, Teso, and have handsome looks positively predict circumcision status. Although when I run these predictors in a linear regression with price, almost all become negative and not statistically significant at 10 percent.[36] So although I find that some client characteristics are linked to circumcision status, these characteristics do not predict price.

I run a similar specification, with the uncircumcised status of clients as an instrument for clients' disutility for condoms to account for the fact that my clients' disutility for condoms measure may be biased given it is subjective to sex worker perceptions of clients. I exploit evidence that suggests that circumcision can be associated with decreased penile functioning, penile sensitivity and sexual pleasure (Kim and Pang 2007; Fink et al. 2002). Results of this 2SLS specification rejects clients' disutility for condoms as the source of

[33]Sex workers can decline a sexual transaction with an uncircumcised client, or avoid clients they know to be uncircumcised from previous sexual encounters but for an overwhelming majority of sex workers, the choice of having sex with an uncircumcised client is largely outside their control.

[34]Many studies show that uncircumcised men are relatively more likely to get infected with HIV/AIDS, genital herpes, syphilis, chancroid and other STIs. For further reading on this see for instance Bailey et al. (2007); Gray et al. (2007); Weiss et al. (2006); Auvert et al. (2005); Weiss et al. (2000); and Bongaarts et al. (1989).

[35]Results not shown but available upon request.

[36]Results not shown but available upon request.

the price premium for unprotected sex.[37] Once again, the uncircumcised status of clients is a weak instrument for clients' disutility for condoms.

More generally, the empirical estimates in this paper may suffer from the endogeneity matching problem akin to that described by Ackerberg and Botticini (2002). The sex market's *invisible hand* does not randomly match clients to sex workers. Rather, they may match on some unobservables such as their bargaining power, which may introduce bias in my empirical estimates. The panel nature of the data help account for this if you believe sex worker observables are time-invariant. Ackerberg and Botticini (2002) suggest as a first step looking at pairwise correlations between the principal and agent, in this case, the sex worker and her clients. I do this by regressing client observables on all sex worker observables.[38] I find that being a risky client is positively related to sex workers' tribe, widow status, divorce status, and sex work experience. Handsome clients are also more likely to have sex with younger sex workers, who have relatively more sex work experience, but are less likely to be able to read in Kiswahili. Crucially, client ethnicity is not related to sex worker ethnicity so there seems to be no suggestive evidence of matching on tribal affiliation. In any case, in as much as this endogenous matching on some observable is present in the data, my estimates may be biased, and in ways that may or may not overestimate the compensating differential for pregancy risk as the source of the price premium for unprotected sex.

A final issue in support of a compensating differential for STI risk as the source of the price premium for unprotected sex is the positive and statistically significant findings from Arunachalam and Shah (2013), Robinson and Yeh (2011), among others and including this paper. The inference on this empirical result is that since STI transmission, most importantly, HIV transmission, is more likely during unprotected anal sex then this supports a compensating differential for STI risk as the source of the price premium for unprotected sex. However, anal sex with a condom also exhibits a strongly positive

[37]Results not shown but available upon request.
[38]Results not shown, but available upon request

and statistically significant effect on prices.[39] Moreover, Štulhofer and Ajduković (2011) finds that anal sex is usually associated with anodyspareunia[40] and that almost half of women surveyed who have had 2 or more anal sexual intercourse in the past year, discontinued anal sex due to pain and discomfort while Stadler et al. (2007) documents that anal sex in South Africa— a context relatively similar to western Kenya where the data used in this paper was collected— is often associated with sexual coercion by men, though also sexual pleasure. Consequently, it is not evident, a priori, that an anal sex premium exists because of being compensated for STI risk or sexual discomfort and/or is it reflective of anodyspareunia, with more anodyspareunic sex workers being relatively more compensated for anal sex.

6 Conclusion

Using a rich dataset from Robinson and Yeh (2011) containing information on risky clients, clients' preferences for condom use, and pregnancy relevant variables, I identify and estimate the source of the price premium for unprotected sex. I find that a compensating differential for pregnancy risk is source of the price premium for unprotected sex. Sex workers are risk averse to pregnancy because of the non-trivial costs of taking care of children. I find that clients' disutility for condoms, the other competing theory, is not a source of the price premium for unprotected sex, while I find suggestive evidence for a compensating differential for STI risk.

Identifying and estimating the source of the price premium is important because the ultimate goal of public policy should be to reduce incentives of sex workers to supply unprotected sex and clients to demand unprotected sex. Because sex workers contribute to the transmission of HIV/AIDS and it requires billions of dollars to take care for vulnerable children such as HIV/AIDS orphans (Stover et al. 2007), understanding sex

[39] Results not shown, but available upon request.

[40] Pain during receptive anal intercourse.

workers' fertility preferences and reducing their incentives to have unprotected sex will save resource-constraints governments in the developing world money that can be better targeted to intervene with sex workers and clients. Knowledge about the source of the price premium for unprotected sex is informative and prescriptive when determining how public health interventions should be targeted. If a compensating differential for pregnancy risk is the source of the price premium for unprotected sex, as this paper argues, then greater birth control coverage should reduce pregnancy risk and thus the price premium for unprotected sex, and because this will reduce incentives to have unprotected sex, we should expect less STI and HIV/AIDS transmission, as a result of less unprotected sex. This paper's findings add to the positive effects of birth control in controlling the transmission of HIV/AIDS in addition to other developmental benefits of contraceptives, such as those documented in Miller (2010).

References

Ackerberg, D. A. and M. Botticini (2002). Endogenous matching and the empirical determinants of contract form. *Journal of Political Economy 110*(3), 564–591.

Arunachalam, R. and M. Shah (2013). Compensated for life: Sex work and disease risk. *Journal of Human Resources 48*(2), 345–369.

Auvert, B., D. Taljaard, E. Lagarde, J. Sobngwi-Tambekou, R. Sitta, and A. Puren (2005). Randomized, controlled intervention trial of male circumcision for reduction of hiv infection risk: the anrs 1265 trial. *PLoS medicine 2*(11), e298.

Bailey, R. C., S. Moses, C. B. Parker, K. Agot, I. Maclean, J. N. Krieger, C. F. Williams, R. T. Campbell, and J. O. Ndinya-Achola (2007). Male circumcision for hiv prevention in young men in kisumu, kenya: a randomised controlled trial. *The Lancet 369*(9562), 643–656.

Beads, C. (2013). Cycle beads.

Becker, G. S. (1993). *A Treatise on the Family*. Harvard university press.

Bongaarts, J., P. Reining, P. Way, and F. Conant (1989). The relationship between male circumcision and hiv infection in african populations. *Aids 3*(6), 373–378.

Davis, K. R. and S. C. Weller (1999). The effectiveness of condoms in reducing heterosexual transmission of hiv. *Family planning perspectives*, 272–279.

Delavande, A. and H.-P. Kohler (2012). The impact of hiv testing on subjective expectations and risky behavior in malawi. *Demography 49*(3), 1011–1036.

Dunson, D. B., D. D. Baird, A. Wilcox, and C. Weinberg (1999). Day-specific probabilities of clinical pregnancy based on two studies with imperfect measures of ovulation. *Human Reproduction 14*(7), 1835–1839.

Dunson, D. B., B. Colombo, and D. D. Baird (2002). Changes with age in the level and duration of fertility in the menstrual cycle. *Human reproduction 17*(5), 1399–1403.

Dupas, P. and J. Robinson (2012). The (hidden) costs of political instability: Evidence from kenya's 2007 election crisis. *Journal of Development Economics 99*(2), 314 – 329.

Edlund, L. and E. Korn (2002). A theory of prostitution. *Journal of Political Economy 110*(1), 181–214.

Fink, K. S., C. C. Carson, and R. F. DeVELLIS (2002). Adult circumcision outcomes study: effect on erectile function, penile sensitivity, sexual activity and satisfaction. *The Journal of urology 167*(5), 2113–2116.

Freund, M. (1962). Interrelationships among the characteristics of human semen and factors affecting semen-specimen quality. *Journal of Reproduction and Fertility 4*(2), 143–159.

Gertler, P., M. Shah, and S. M. Bertozzi (2005). Risky business: the market for unprotected commercial sex. *Journal of Political Economy 113*(3), 518–550.

Gray, R. H., G. Kigozi, D. Serwadda, F. Makumbi, S. Watya, F. Nalugoda, N. Kiwanuka, L. H. Moulton, M. A. Chaudhary, M. Z. Chen, et al. (2007). Male circumcision for hiv prevention in men in rakai, uganda: a randomised trial. *The Lancet 369*(9562), 657–666.

Ichino, A. and E. Moretti (2009). Biological gender differences, absenteeism, and the earnings gap. *American Economic Journal: Applied Economics 1*(1), 183–218.

Kim, D. and M.-G. Pang (2007). The effect of male circumcision on sexuality. *BJU international 99*(3), 619–622.

Levitt, S. D. and S. A. Venkatesh (2007). An empirical analysis of street-level prostitution. Preliminary draft, September.

MacLeod, J. and R. Z. Gold (1953). The male factor in fertility and infertility. vi. semen quality and certain other factors in relation to ease of conception. *Obstetrical & Gynecological Survey 8*(4), 604–606.

Miller, G. (2010). Contraception as development? new evidence from family planning in colombia*. *The Economic Journal 120*(545), 709–736.

Miller, G., J. M. Tybur, and B. D. Jordan (2007). Ovulatory cycle effects on tip earnings by lap dancers: economic evidence for human estrus? *evolution and human behavior 28*(6), 375–381.

Ntumbanzondo, M., R. Dubrow, L. M. Niccolai, K. Mwandagalirwa, and M. Merson (2006). Unprotected intercourse for extra money among commercial sex workers in kinshasa, democratic republic of congo. *AIDS care 18*(7), 777–785.

Oster, E. (2005). Sexually transmitted infections, sexual behavior, and the hiv/aids epidemic. *The Quarterly Journal of Economics 120*(2), 467–515.

Poland, M., K. Moghissi, P. Giblin, J. Ager, and J. Olson (1985). Variation of semen measures within normal men. *Fertility and sterility 44*(3), 396–400.

Posner, R. A. (1992). *Sex and reason.* Harvard University Press.

Rao, V., I. Gupta, M. Lokshin, and S. Jana (2003). Sex workers and the cost of safe sex: the compensating differential for condom use among calcutta prostitutes. *Journal of Development Economics 71*(2), 585–603.

Robinson, J. and E. Yeh (2011). Transactional sex as a response to risk in western kenya. *American Economic Journal: Applied Economics 3*(1), 35–64.

Siow, A. (1998). Differntial fecundity, markets, and gender roles. *Journal of Political Economy 106*(2), 334–354.

Stadler, J., S. Delany, and M. Mntambo (2007). Sexual coercion and sexual desire: ambivalent meanings of heterosexual anal sex in soweto, south africa. *AIDS care 19*(10), 1189–1193.

Stover, J., L. Bollinger, N. Walker, and R. Monasch (2007). Resource needs to support orphans and vulnerable children in sub-saharan africa. *Health policy and planning 22*(1), 21–27.

Štulhofer, A. and D. Ajduković (2011). Should we take anodyspareunia seriously? a descriptive analysis of pain during receptive anal intercourse in young heterosexual women. *Journal of sex & marital therapy 37*(5), 346–358.

UNAIDS (2009, March). Unaids guidance note on hiv and sex work.

UNAIDS (2010). Unaids report on the global aids epidemic 2010.

UNAIDS (2012). Unaids report on the global aids epidemic 2012.

University, G. (2013). Standard days method. Institute for Reproductive Health.

Weiss, H., S. Thomas, S. Munabi, and R. Hayes (2006). Male circumcision and risk of syphilis, chancroid, and genital herpes: a systematic review and meta-analysis. *Sexually Transmitted Infections 82*(2), 101–110.

Weiss, H. A., M. A. Quigley, and R. J. Hayes (2000). Male circumcision and risk of hiv infection in sub-saharan africa: a systematic review and meta-analysis. *Aids 14*(15), 2361–2370.

Weitzman, L. J. and R. B. Dixon (1979). Child custody awards: Legal standards and empirical patterns for child custody, support and visitation after divorce. *UCDL Rev. 12*, 471.

Wilcox, A. J., D. B. Dunson, C. R. Weinberg, J. Trussell, and D. D. Baird (2001). Likelihood of conception with a single act of intercourse: providing benchmark rates for assessment of post-coital contraceptives. *Contraception 63*(4), 211–215.

Wilcox, A. J., C. R. Weinberg, and D. D. Baird (1995). Timing of sexual intercourse in relation to ovulationeffects on the probability of conception, survival of the pregnancy, and sex of the baby. *New England Journal of Medicine 333*(23), 1517–1521.

7 Tables

7.1 Table 1: Sex Worker Information

Summary Statistics	
Age	28.43
	(6.98)
Start Age	18.67
	(5.14)
Experience	9.84
	(6.07)
Years of Education	9.20
	(2.69)
Number of Biological Children	2.06
	(1.83)
Marital Status	
Never Married	0.44
	(0.50)
Widowed	0.23
	(0.42)
Divorced	0.20
	(0.40)
Cohabitating	0.13
	(0.33)
Can Read Kiswahili	0.95
	(0.21)
Can Write Kiswahili	0.88
	(0.33)
Tribe	
Luo	0.51
	(0.50)
Luhya	0.39
	(0.49)
HIV Knowledge Test Score (0-1 Scale)	0.94
	(0.06)
Vaginal Sex	0.94
	(0.10)
Income from Sex Work per Day (Ksh)	850.71
	(460.99)
Hours in Sex Work per Day	7.35
	(2.40)
Income from Other Work per Day (Ksh)	106.08
	(120.14)
Hours in Other Work per Day	7.73
	(39.33)
Hourly Wage from Sex Work (Ksh)	151.77
	(92.24)
Hourly Wage from Other Work (Ksh)	41.07
	(38.54)
Observations	192

Note: Means are presented with standard deviations in parentheses.

7.2 Table 2: Client Information

	Summary Statistics
Disutility for Condoms	0.45
	(0.45)
Disutility for Condoms for Unrisky Clients	0.21
	(0.38)
Risky Clients	0.46
	(0.46)
Uncircumcised Clients	0.25
	(0.40)
Poor Clients	0.09
	(0.26)
Clean Clients	0.62
	(0.44)
Handsome Clients	0.54
	(0.46)
Tribe	
Luhya	0.25
	(0.40)
Luo	0.24
	(0.39)
Kikuyu	0.14
	(0.32)
Teso	0.09
	(0.26)
Kalenjin	0.06
	(0.22)
Somali	0.06
	(0.23)
Akamba	0.05
	(0.21)
Ugandan	0.04
	(0.17)
Occupation	
Government	0.27
	(0.41)
Truck Driver	0.19
	(0.36)
Business	0.19
	(0.36)
Hotel	0.10
	(0.27)
Shop	0.09
	(0.26)
Boda Boda (Bike Taxi) Driver	0.08
	(0.25)
Bar	0.05
	(0.20)
Other	0.03
	(0.16)
Observations	3,656

Note: Means are presented with standard deviations in parentheses.

7.3 Table 3: Sexual Transactions

Summary Statistics

Price for Sexual Transaction (Ksh)	509.51
	(286.41)
Unprotected Vaginal Sex	0.08
	(0.14)
STI	0.03
	(0.07)
STI Risk	0.03
	(0.10)
Birth Control	0.60
	(0.49)
Observations	192

Note: Means are presented with standard deviations in parentheses.

7.4 Table 4: Probability of Pregnancy as an Instrument for Unprotected Sex

Probability of Pregnancy as an Instrument for Unprotected Sex

	(1)	(2)
	No Condom	No Condom
Probability of Pregnancy 1	-1.251***	
	(0.283)	
Probability of Pregnancy 2		-0.353***
		(0.101)
Constant	0.170*	0.098
	0.096	0.075
CSW Controls	Yes	Yes
Client Controls	Yes	Yes
Time Controls	Yes	Yes
Sexual Transactions	1827	1744
R-Squared	0.720	0.829
F Statistic	1827	2651

Notes:

a. Standard errors clustered at the sex worker level in parentheses.

b. *** 1% level of confidence.

c. ** 5% level of confidence.

d. * 10% level of confidence.

e. CSW Controls include sex workers' age, experience, education, literacy, tribe, marital status, and number of own children.

f. Client Controls include whether clients are regular, risky, wealthy, clean, handsome, tribe, occupation, and disutility for condoms.

g. Time Controls are just day and month dummies.

h. Other controls not shown include unprotected anal sex, anal sex, and vaginal sex.

7.5 Table 5: Second Stage of Compensating Differential for Pregnancy Risk

Table 2: Pregnancy Risk as Source of the Price Premium for Unprotected Sex, Second Stage

	(1)	(2)	(3)	(4)	(5)	(6)
	Ksh	Ksh	Ksh	Ksh	Ksh	Ksh
No Condom	839.9***	611.9*	826.3**	586.1*	515.1**	398.7*
	(321.9)	(312.2)	(338.5)	(355.7)	(242.8)	(227.5)
No Birth Control	130.4	159.2*	119.5	163.4*	136.8	172.4*
	(84.34)	(82.05)	(88.84)	(87.87)	(97.49)	(99.54)
No Condom×No Birth Control	-838.1**	-662.2**	-859.7**	-671.7*	-596.4**	-562.3**
	(341.3)	(334.8)	(344.8)	(362.8)	(264.3)	(261.1)
No Condom×Probability of Pregnancy 1	-7922.2**		-8285.8**		-4762.4	
	(3176.6)		(3700.3)		(3129.0)	
No Birth Control×Probability of Pregnancy 1	-1112.1***		-1330.4***		-850.8	
	(307.2)		(317.0)		(585.2)	
No Condom×No Birth Control×Probability of Pregnancy 1	7587.9**		8568.6**		5547.1*	
	(3285.1)		(3782.3)		(3285.5)	
No Condom×Probability of Pregnancy 2		-1692.0*		-1689.5		-1072.8
		(952.9)		(1175.7)		(830.3)
No Birth Control×Probability of Pregnancy 2		-416.7***		-530.8***		-372.4***
		(102.6)		(100.0)		(106.3)
No Condom×No Birth Control×Probability of Pregnancy 2		1786.6*		1906.4		1522.0*
		(974.0)		(1195.0)		(902.8)
CSW Controls	No	No	Yes	Yes	Yes	Yes
Client Controls	No	No	No	No	Yes	Yes
Time Controls	No	No	Yes	Yes	Yes	Yes
Constant	500.3***	502.8***	418.7	467.1*	284.5	239.3
	(105.1)	(106.0)	(288.9)	(275.3)	(377.0)	(371.1)
Ksh[e]	545.493	545.666	544.286	544.339	603.023	604.041
Sexual Transactions	5799	5584	5598	5388	1827	1744
R-Squared	.	0.00734	0.0294	0.0728	0.154	0.182
Chi-Squared	37.04	27.72	134.2	145.8	1763.8	1286.6

Notes:
a. Standard errors clustered at the sex worker level in parentheses.
b. *** 1% level of confidence.
c. ** 5% level of confidence.
d. * 10% level of confidence.
e. Mean of Ksh for each regression.
f. CSW Controls include sex workers' age, experience, education, literacy, tribe, marital status, and number of own children.
g. Client Controls include whether clients are regular, risky, wealthy, clean, handsome, tribe, occupation, and disutility for condoms.
h. Time Controls are just day and month dummies.
i. Other controls not shown include unprotected anal sex, anal sex, and vaginal sex.
j. Probability of pregnancy is by design excluded in this second stage.

7.6 Table 7: Pregnancy Risk, STI Risk, and Clients' Disutility for Condoms as Sources of the Price Premium for Unprotected Sex

Table 3: Pregnancy Risk as Sources of the Price Premium for Unprotected Sex with Sex Worker Fixed Effects

	(1)	(2)	(3)	(4)	(5)	(6)
	Ksh	Ksh	Ksh	Ksh	Ksh	Ksh
No Condom	551.6	377.9	461.7	324.8	496.3*	310.5
	(362.1)	(328.3)	(292.0)	(285.5)	(284.3)	(259.2)
No Birth Control	195.9*	218.4**	128.9	159.8	134.8	166.7*
	(100.4)	(102.4)	(99.79)	(104.1)	(97.56)	(99.45)
Risky Client	-107.6*	-131.5**	-86.24*	-102.0**	-109.8**	-132.3**
	(57.00)	(54.31)	(50.47)	(49.86)	(52.44)	(51.67)
Disutility for Condoms	39.34	17.51	-10.87	-20.39	13.66	1.936
	(61.09)	(58.16)	(52.49)	(49.07)	(54.41)	(52.13)
No Condom×No Birth Control×Probability of Pregnancy 1	5316.5		4398.6		5730.7*	
	(3843.4)		(3122.2)		(3010.9)	
No Condom×No Birth Control×Probability of Pregnancy 2		1512.6		1245.9		1595.4*
		(1130.6)		(939.0)		(875.9)
Risky Client×No Condom	89.20	240.9	69.26	192.8	76.07	229.5*
	(200.4)	(176.4)	(159.3)	(150.0)	(157.1)	(138.2)
Disutility for Condoms×No Condom	-127.9	-26.39	-66.49	2.590	-64.77	10.78
	(156.3)	(146.1)	(144.1)	(137.6)	(143.6)	(131.7)
No Condom×No Birth Control	-632.2*	-588.7*	-508.7*	-480.7	-593.0**	-541.4**
	(335.0)	(341.4)	(281.3)	(298.7)	(270.3)	(272.3)
No Condom×Probability of Pregnancy 1	-5618.8		-4330.4		-4879.6*	
	(3794.7)		(2999.7)		(2921.2)	
No Birth Control×Probability of Pregnancy 1	-987.0		-988.4		-846.0	
	(636.5)		(610.8)		(581.2)	
No Condom×Probability of Pregnancy 2		-1342.3		-1020.4		-1107.7
		(1061.2)		(885.2)		(811.8)
No Birth Control×Probability of Pregnancy 2		-342.3**		-365.7***		-367.8***
		(138.3)		(113.3)		(104.0)
CSW Controls	No	No	Yes	Yes	Yes	Yes
Client Controls	No	No	No	No	Yes	Yes
Time Controls	No	No	Yes	Yes	Yes	Yes
Constant	392.1***	419.5***	386.4	394.4	290.8	301.7
	(130.7)	(129.2)	(267.3)	(283.9)	(390.0)	(380.8)
Ksh[e]	605.242	606.453	604.299	605.355	603.023	604.041
Sexual Transactions	1872	1788	1864	1781	1827	1744
R-Squared	0.0190	0.0589	0.130	0.156	0.157	0.192
Chi-Squared	31.49	34.96	152.2	255.9	2682.3	1963.1

Notes:
a. Standard errors clustered at the sex worker level in parentheses.
b. *** 1% level of confidence.
c. ** 5% level of confidence.
d. * 10% level of confidence.
e. Mean of Ksh for each regression.
f. CSW Controls include sex workers' age, experience, education, literacy, tribe, marital status, and number of own children.
g. Client Controls include whether clients are regular, risky, wealthy, clean, handsome, tribe, occupation, and disutility for condoms.
h. Time Controls are just day and month dummies.
i. Other controls not shown include unprotected anal sex, anal sex, and vaginal sex.

7.7 Table 8: Sex Worker Fixed Effects

Table 3: Pregnancy Risk as Sources of the Price Premium for Unprotected Sex with Sex Worker Fixed Effects

	(1)	(2)	(3)	(4)	(5)	(6)
	Ksh	Ksh	Ksh	Ksh	Ksh	Ksh
No Condom	839.9***	611.9*	826.3**	586.1*	515.1**	398.7*
	(321.9)	(312.2)	(338.5)	(355.7)	(242.8)	(227.5)
No Birth Control	.	.	.	.	.	.
	.	.	.	.	.	.
Probability of Pregnancy 1	-386.3**		-270.4*		-147.0	
	(186.7)		(153.9)		(230.1)	
Probability of Preganancy 2		-48.19		-12.88		-18.11
		(60.30)		(54.73)		(80.94)
No Condom×No Birth Control	100.3	56.37	40.25	-5.872	38.18	-3.376
	(80.03)	(79.50)	(60.43)	(61.80)	(71.37)	(94.93)
No Condom×Probability of Pregnancy 1	131.1		-125.3		518.5	
	(331.2)		(458.1)		(527.6)	
No Birth Control×Probability of Pregnancy 1	48.14		-112.6		-135.6	
	(260.5)		(238.3)		(524.0)	
No Condom×No Birth Control×Probability of Pregnancy 1	-488.4		142.4		512.0	
	(773.6)		(802.6)		(1157.9)	
No Condom×Probability of Pregnancy 2		15.48		-46.49		30.61
		(87.19)		(112.4)		(120.5)
No Birth Control×Probability of Pregnancy 2		-115.2		-162.6**		-106.7
		(85.31)		(79.65)		(126.6)
No Condom×No Birth Control×Probability of Pregnancy 2		107.7		251.4		395.4
		(200.3)		(198.0)		(393.7)
CSW Controls	No	No	Yes	Yes	Yes	Yes
Client Controls	No	No	No	No	Yes	Yes
Time Controls	No	No	Yes	Yes	Yes	Yes
Constant	456.4***	463.5***	423.0***	427.6***	419.1***	578.2***
	(59.19)	(58.70)	(60.73)	(60.24)	(133.0)	(130.5)
Ksh[e]	545.493	545.666	544.286	544.339	603.023	604.041
Sexual Transactions	5799	5584	5598	5388	1827	1744
R-Squared	0.0216	0.0203	0.0144	0.0139	0.0339	0.0350
F-Statistic	2.364	2.403	2.709	2.086	9.760	6.983

Notes:
a. Standard errors clustered at the sex worker level in parentheses.
b. *** 1% level of confidence.
c. ** 5% level of confidence.
d. * 10% level of confidence.
e. Mean of Ksh for each regression.
f. CSW Controls include sex workers' age, experience, education, literacy, tribe, marital status, and number of own children.
g. Client Controls include whether clients are regular, risky, wealthy, clean, handsome, tribe, occupation, and disutility for condoms.
h. Time Controls are just day and month dummies.
i. Other controls not shown include unprotected anal sex, anal sex, and vaginal sex.
j. Birth control drops out by design because sex workers are not getting on and off birth control during each menstrual cycle.

7.8 Table 10: Placebo Test

Placebo Test: Pregnancy Risk with Sex Workers Who Are On Birth Control

	(1)	(2)
	Ksh	Ksh
No Condom	437.0	286.7
	(338.6)	(301.5)
Risky Client	-98.27	-141.8**
	(67.50)	(64.49)
Disutility for Condoms	38.99	13.42
	(61.62)	(59.41)
Risky Client×No Condom	109.7	322.2
	(242.8)	(210.0)
Disutility for Condoms×No Condom	-291.5**	-168.6
	(144.9)	(128.2)
No Condom×Probability of Pregnancy	-3945.3	-1172.9
	(2931.1)	(861.1)
CSW Controls	Yes	Yes
Client Controls	Yes	Yes
Time Controls	Yes	Yes
Constant	-176.7	278.9
	(235.8)	(200.7)
Ksh[e]	559.012	560.481
Sexual Transactions	1210	1155
R-Squared	0.0523	0.102
Chi-Squared	980.3	1403.7

Notes:

a. Standard errors clustered at the sex worker level in parentheses.

b. *** 1% level of confidence.

c. ** 5% level of confidence.

d. * 10% level of confidence.

e. Mean of Ksh for each regression.

f. CSW Controls include sex workers' age, experience, education, literacy, tribe, marital status, and number of own children.

g. Client Controls include whether clients are regular, risky, wealthy, clean, handsome, tribe, occupation, and disutility for condoms.

h. Time Controls are just day and month dummies.

i. Other controls not shown include unprotected anal sex, anal sex, and vaginal sex.

j. Column 1 is for the first measure of probability of pregnancy, while column 2 is for the second measure of probability of pregnancy.

7.9 Table 8: Heterogeneity

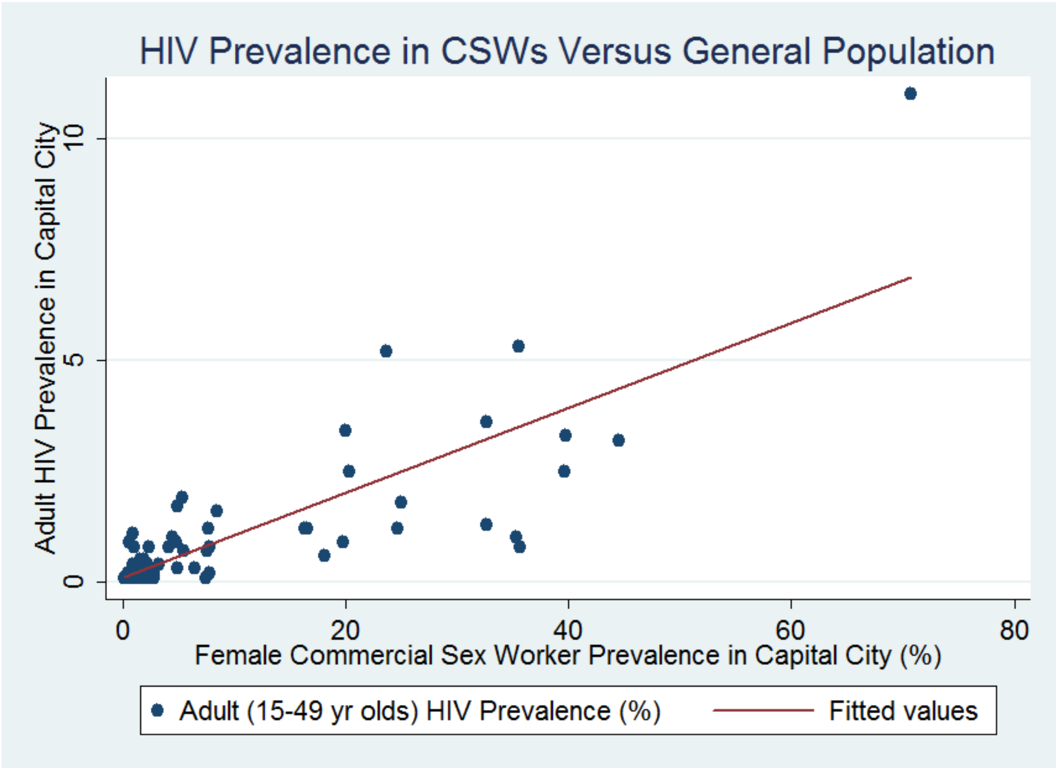
Table 3: Heterogeneity of Compensating Differential for Pregnancy Risk as Source of the Price Premium for Unprotected Sex

	(1)	(2)	(3)	(4)	(5)	(6)
	Ksh	Ksh	Ksh	Ksh	Ksh	Ksh
No Condom	496.3*	310.5	550.2**	594.7	496.3*	310.5
	(284.3)	(259.2)	(272.8)	(366.5)	(284.3)	(259.2)
No Birth Control	134.8	166.7*	80.31	116.0	134.8	166.7*
	(97.56)	(99.45)	(127.0)	(131.2)	(97.56)	(99.45)
Risky Client	-109.8**	-132.3**	-34.86	-66.34	-109.8**	-132.3**
	(52.44)	(51.67)	(67.19)	(64.16)	(52.44)	(51.67)
Disutility for Condoms	13.66	1.936	-99.96	-103.4*	13.66	1.936
	(54.41)	(52.13)	(65.27)	(62.54)	(54.41)	(52.13)
No Condom×No Birth Control×Probability of Pregnancy 1	5730.7*		6002.0**		5730.7*	
	(3010.9)		(2842.8)		(3010.9)	
No Condom×No Birth Control×Probability of Pregnancy 2		1595.4*		2510.8*		1595.4*
		(875.9)		(1293.1)		(875.9)
Risky Client×No Condom	76.07	229.5*	-10.51	94.24	76.07	229.5*
	(157.1)	(138.2)	(155.4)	(137.5)	(157.1)	(138.2)
Disutility for Condoms×No Condom	-64.77	10.78	158.3	212.9	-64.77	10.78
	(143.6)	(131.7)	(199.5)	(180.3)	(143.6)	(131.7)
No Condom×No Birth Control	-593.0**	-541.4**	-551.5**	-733.0*	-593.0**	-541.4**
	(270.3)	(272.3)	(260.8)	(382.1)	(270.3)	(272.3)
No Condom×Probability of Pregnancy 1	-4879.6*		-5866.4**		-4879.6*	
	(2921.2)		(2721.8)		(2921.2)	
No Birth Control×Probability of Pregnancy 1	-846.0		2.633		-846.0	
	(581.2)		(564.8)		(581.2)	
No Condom×Probability of Pregnancy 2		-1107.7		-2047.5*		-1107.7
		(811.8)		(1188.5)		(811.8)
No Birth Control×Probability of Pregnancy 2		-367.8***		-195.9*		-367.8***
		(104.0)		(105.0)		(104.0)
CSW Controls	No	No	Yes	Yes	Yes	Yes
Client Controls	No	No	No	No	Yes	Yes
Time Controls	No	No	Yes	Yes	Yes	Yes
Constant	290.8	301.7	-371.6	-254.3	290.8	301.7
	(390.0)	(380.8)	(701.3)	(683.4)	(390.0)	(380.8)
Ksh^e	603.023	604.041	615.993	620.74	603.023	604.041
Sexual Transactions	1827	1744	1096	1045	1827	1744
R-Squared	0.157	0.192	0.215	0.242	0.157	0.192
Chi-Squared	2682.3	1963.1	6851.1	95744.8	2682.3	1963.1

Notes:
a. Standard errors clustered at the sex worker level in parentheses.
b. *** 1% level of confidence.
c. ** 5% level of confidence.
d. * 10% level of confidence.
e. Mean of Ksh for each regression.
f. CSW Controls include sex workers' age, experience, education, literacy, tribe, marital status, and number of own children.
g. Client Controls include whether clients are regular, risky, wealthy, clean, handsome, tribe, occupation, and disutility for condoms.
h. Time Controls are just day and month dummies.
i. Other controls not shown include unprotected anal sex, anal sex, and vaginal sex.
j. Columns 1-2 are the main specification 2SLS model with the full sample of sex workers.
k. Columns 3-4 are the main specification 2SLS model with sex workers below the average age of 28.43 years old.
l. Columns are the main specification 2SLS model with sex workers with above the average number of own children of 2.06.

A Appendix

B Figures



C Proofs

C.1 Proposition 1

Proof. Recall that the first order conditions give us the following equality: $\frac{U'(P_1Q^*-CQ^*)}{U'(-P_2Q^*)} = \frac{P_2}{P_1-C}[\frac{1-g}{g}]$. Now, because we are mainly concerned with what happens to P_1 and how sex workers chose Q^* let $\frac{1}{U'(-P_2Q^*)}$ and $\frac{P_2}{P_1-C}$ be equal as some constant k so that $kU'(P_1Q^* - CQ^*) = k\frac{1-g}{g}$ and eliminating the constant k the F.O.C. equality reduces to $U'(P_1Q^* - CQ^*) = \frac{1-g}{g}$. Notice that with this assumption implies $P_1 = P_2U'(-P_2Q) + C$ which would mean that the price for unprotected sex consists of the price for protected sex times the marginal disutility of receiving P_2 when $Q > 0$ plus the costs of unprotected sex. Notice also that $P_1 < P_2U'(-P_2Q) + C$ cannot occur if a price premium for unprotected sex exists so that the only other option is $P_1 > P_2U'(-P_2Q) + C$. But for our purposes, I assume that $P_1 = P_2U'(-P_2Q) + C$.

Case 1: $g \to 0$

Notice that as $g \to 0$ then $\frac{1-g}{g} \to \infty$. Thus, to maintain the equality, this implies that $U'(P_1Q^* - CQ^*) \to \infty$. Since $U'(P_1Q^* - CQ^*) \to \infty$ and we know that $\frac{\partial U}{\partial Q} > 0$ it must be that $Q^* \to \infty$.

At equilibrium, if sex workers are willing to provide unprotected sex to maximize their utility and they know that $g \to 0$, for trivially low levels of g sex workers will sell unprotected sex for relatively lower prices, putting downward pressures on P_1 so that $P_1 \to 0$. This result then implies that $\frac{\partial P_1}{\partial g} > 0$ but only through $\frac{\partial Q}{\partial g} < 0$.

Case 2: $g \to 1$

Notice that as $g \to 1$ then $\frac{1-g}{g} \to 0$. Thus, to maintain the equality, this implies that $U'(P_1Q^* - CQ^*) \to 0$. Since $U'(P_1Q^* - CQ^*) \to 0$ and we know that $\frac{\partial U}{\partial Q} > 0$ it must be that $Q^* \to 0$.

At equilibrium, if sex workers are willing to provide unprotected sex to maximize their utility but they know that $g \to \infty$, for non-trivially high levels of g sex workers will sell unprotected sex if and only if prices are relatively higher as compensation for the increased risk of pregnancy, putting upward pressures on P_1 so that $P_1 \to \infty$. This result then implies that $\frac{\partial P_1}{\partial g} > 0$ but only through $\frac{\partial Q}{\partial g} < 0$. $\square$